Properties and Classifications of Matter

PS-3 The student will demonstrate an understanding of various properties and classifications of matter.

PS-3.3 Illustrate the difference between a molecule and an atom.
Taxonomy Level: 2.2-B Understand Conceptual Knowledge

Key Concepts:
Molecule
Atom
Atoms can combine to form molecules

Previous/Future knowledge: In 7th grade, students recognize the atom as the basic building block of matter (7-5.1).
In Physical Science indicators PS-2.1 through 2.4 addressed the parts and properties of atoms. This indicator is meant to introduce students to the concept of chemical bonding. PS-3.4 will require that students classify matter as pure substance or mixture. In preparation for this skill, students must understand the implications of atoms bonding to form molecules. This standard lays the foundation for one of the major types of chemical bonding (PS-4.1 through PS-4.5).

It is essential for students to
- Understand that elemental substances (elements) are composed of only one type of atom.
- Understand that an atom is the smallest unit of an element that can be involved in a chemical reaction.
- Understand that all of the elements are listed on the periodic table.
- Understand that molecular substances are composed of two or more atoms covalently bonded together to make units called *molecules*.
- Understand that a molecule is the smallest particle of a molecular substance that can exist and still have the composition and chemical properties of the substance.

Teacher note: This indicator is an introduction to bonding; illustrating shared electrons and bonding will be addressed in PS-4.1 through PS-4.5.
- Understand the chemical and physical properties of a molecular substance are different from the chemical and physical properties of the component elements.
- Give examples (illustrations) of substances composed of molecules and examples of substances composed of individual atoms (as indicated by the verb illustrate).
  - Examples of molecules may include: CO_2 , SO_2 , H_2O , H_2
  - Examples of individual atoms may include: Na, Ar, He, Cu,
  - Illustrations may be in the form of chemical names, chemical symbols/formulas, verbal descriptions, or pictorial diagram

It is not essential for students to
- Remember all of the chemical formulas for substances;
- Be familiar with chemical nomenclature – writing chemical names;
- Understand that the atoms in metallic substances such as copper are held together by metallic bonds.

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Assessment Guidelines:

The objective of this indicator is to *illustrate* the difference between a molecule and an atom, therefore, the primary focus of assessment should be to give or use illustrations that show the differences in words, pictures, or diagrams between atoms and molecules.

In addition to *illustrate*, assessments may require students to

- *Classify* substances as atoms or molecules when given the chemical names, chemical formula/symbols, verbal descriptions, or pictorial diagrams of substances, and give the reason the category chosen;
- *Summarize* the differences between atoms and molecules in terms of structure;-
- *Compare* atoms to molecules, in terms of structure.